

ABSTRACT

An array processor includes processing elements arranged in clusters which are, in turn, combined in a rectangular array. Each cluster is formed of processing elements which preferably communicate with the processing elements of at least two other clusters. Additionally each inter-cluster communication path is mutually exclusive, that is, each path carries either north and west, south and east, north and east, or south and west communications. Due to the mutual exclusivity of the data paths, communications between the processing elements of each cluster may be combined in a single inter-cluster path. That is, communications from a cluster which communicates to the north and east with another cluster may be combined in one path, thus eliminating half the wiring required for the path. Additionally, the length of the longest communication path is not directly determined by the overall dimension of the array, as it is in conventional torus arrays. Rather, the longest communications path is limited only by the inter-cluster spacing. In one implementation, transpose elements of an $N \times N$ torus are combined in clusters and communicate with one another through intra-cluster communications paths. Since transpose elements have direct connections to one another, transpose operation latency is eliminated in this approach. Additionally, each PE may have a single transmit port and a single receive port. As a result, the individual PEs are decoupled from the topology of the array.